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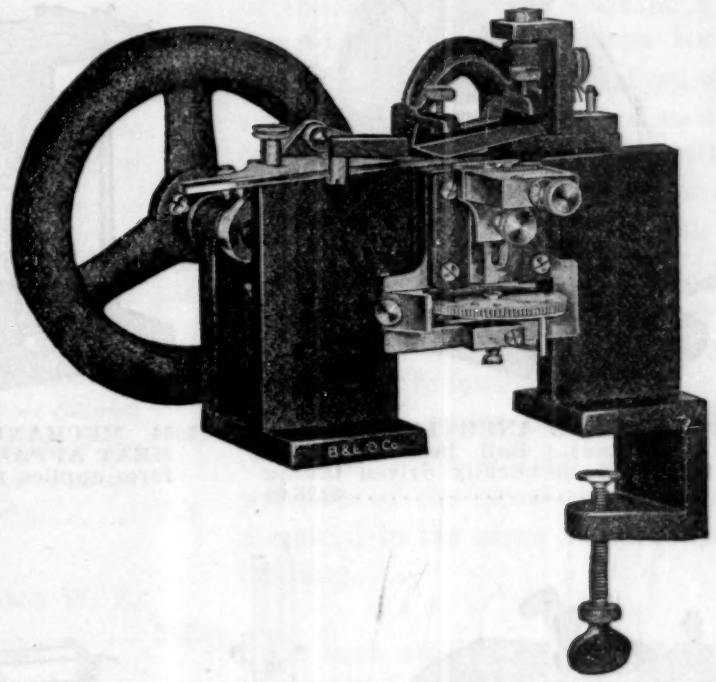

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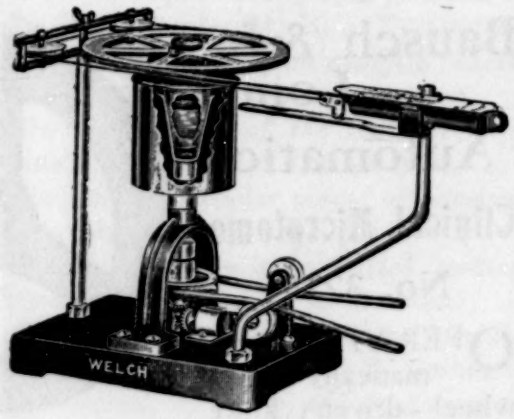

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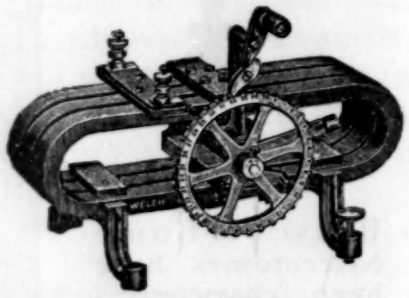

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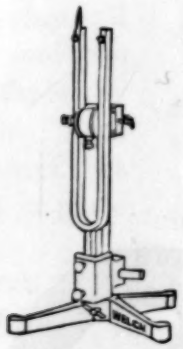

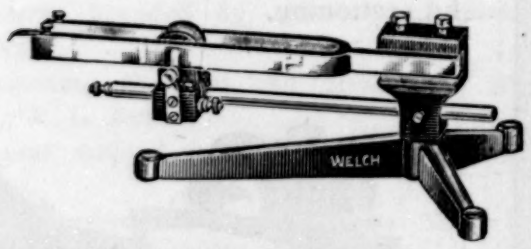

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SOME PROBLEMS OF MEDICAL INVESTIGATION AND MEDICAL EDUCATION[1]

THE laying of a corner-stone is an occasion on which one's imagination as to the future is stimulated to activity and one's thoughts naturally turn toward consideration of the probable future activity of the building whose erection is to proceed. This structure, whose corner-stone we lay to-day, is to be a hospital for the clinical activities of a graduate school of medicine, and it is a memorial to perpetuate for all time a name—Albert Merritt Billings. Broadly speaking, herein lie the purposes of the structure to be erected on this corner-stone. The corner-stone itself, architecturally considered, is an entirely dispensable feature of a building and in no wise determines the character of the structure to be built in due season, following its laying. However, about a corner-stone center the ideas and sentiments which in future years will be the real expression of the purposes of the structure and constitute an undying memorial to the name honored by the donors of the building.

On such an occasion it may not be inappropriate to devote a little time to the consideration of some problems of medical investigation and medical education. It is recognized very generally to-day that all great hospitals have three functions, care of the sick, investigation of disease and education of all patients, nurses, physicians and surgeons, that pass its portals. Different institutions may stress in particular some one of these functions; no hospital, worthy of the name, may neglect entirely any of this triad. A hospital is an indispensable unit in a school of medicine, be that school intended primarily for investigation or to educate practitioners or teachers and investigators.

The hospital constitutes a fundamental difference between a graduate school of medicine and all other graduate schools, inasmuch as it introduces into the problem the care of sentient human beings in the guise of patients. It is an inescapable fact that the first concern of every hospital is the best possible care of its patients, whatever of the three great functions of a hospital is to be stressed by the particular

[1] Address delivered at the laying of the corner-stone of the Albert Merritt Billings Hospital of the University of Chicago, at Chicago, Illinois, on October 2, 1925.

institution. The hospital may select patients as it wills. Once selected, patients must be given the best service possible in a form so personal that each patient feels that the institution is serving him in particular. These facts must be taken into account in the selection of staff, from chiefs to subordinates, in the character and limitations of investigation and in the methods of education.

The ideas of the function of a hospital expressed above have been a gradual growth over a long period of time, but it is only comparatively recently that they have come into general recognition. Perhaps the lay public does not yet fully recognize them, though rapidly they are adopting this conception of a hospital. With the more general recognition of these functions of a hospital has gone a progressive improvement in medical education.

Many factors undoubtedly have played a part in bringing about these changes, but this is not the appropriate time to discuss them. At the same time I do wish to emphasize one factor whose very great importance it seems to me has not been sufficiently recognized by critics and prophets of medical education. I refer to the part played by the great medical men here in this country that were the leaders in medicine of the generation just preceding our own, to men like the elder Janeway in New York, Fitz and Shattuck in Boston, Osler in Baltimore and your own Billings here in Chicago, to mention but a few and only the internists of that large coterie of medical men who by example and precept were the leaders of the generation whose professional activity has but recently ceased. These men, more than any other influences, are responsible for our developments in medicine to-day. They had the vision, the courage, the perseverance and the character to do the work, without which we would not be to-day where we are. They laid the foundations on which have been builded the present-day structure of medical education and hospital organization. To them, rather than to critics of medical schools and theorists in medical pedagogy, should go our grateful thanks for present-day conditions.

I often wonder, with many doubts I must confess, whether our leaders of to-day are of the caliber of these men, or merely shine by reason of the material equipment supplied by great philanthropists and foundations.

As I imagine the future I picture two general types of hospitals, the one primarily concerned in the expeditious care of many patients, the other chiefly devoted to medical education and investigation. Both, it seems to me, will be quite different from what we now find developed in most, if not all, of our medical centers. In the former the ambulatory diagnostic clinic will play a larger part, for diagnostic methods, though numerous and complicated, rapidly are becoming simplified so that they may be applied to patients who make periodic visits to the hospital at appointed hours. Many more patients than now will be taken into our hospitals who already have been completely worked up and are admitted ready for appropriate therapeutic procedures. This study, preliminary to admission, as well as that on those admitted unworked up, probably will be carried out by a general diagnostic service, whether the patients' future therapy is to be medical or surgical or of other sort. Medical specialism here will have a decreasing import. Within the hospital therapeutic measures of all types will be speedily instituted, and in a relatively short time, for most patients, they will be continued in out-of-town branches somewhat of the nature of convalescent homes. Here surgical cases will spend much of the period necessary for convalescence from therapeutic methods of the surgeon, and medical patients will undergo régimes of dietary or medicinal or mechanical treatment, perhaps to be returned at intervals to the central hospital for such tests of function, etc., as can not be carried out in the convalescent branch of the institution. Easy methods of transportation make possible this arrangement. The beds of such a central hospital will be occupied by each patient for a far shorter average period than at present. Diagnostic work in large part will be done before admission, while convalescent care and observational methods of treatment will be applied in these country branches, where, with the economic advantages of a lower land cost and less expensive construction, will be combined the therapeutic advantages of fresh air, unobstructed sunlight and nearness to God's green earth. Internes and resident staff will serve in rotation in both the urban and country branches of the work. Surgery as such will be recognized as but a form of therapy, while both surgeon and physician will work in the general diagnostic clinic without regard to whether he is on surgical, medical or special service, but rather as a man skilled in some particular diagnostic method which will form part of the basis of the final diagnosis. Investigation and education too will be part of the function of such a hospital, but its efficiency will be measured largely in the terms of excellent and expeditious care of patients.

I have merely outlined in general terms my idea of this type of hospital of the future. Many details, of course, will be developed differently in different places. To my mind most of our large hospitals will

take on this type. Some already are being developed along these lines.

In contrast, as in my imaginings I think of hospitals, will be the other type of hospital—the one primarily concerned in medical investigation and medical education. Here special types of diseases will be admitted for study. Patients will remain much longer than in the former type of institution. Resident and visiting staff will be larger in proportion to number of patients than in a hospital primarily concerned in the expeditious care of patients. More staff members, possibly all, will devote their entire time to work within the walls of the institution. This type of hospital will have all the equipment for diagnosis and care of patients found in the other type of institution, and in addition extensive equipment for the investigation of such problems as are chosen for study. No form of laboratory of the biological and physical sciences, no type of apparatus should be foreign to such a hospital, provided the problems studied need them for their solution. Per capita cost for patients of necessity will be very high.

In general terms such a hospital will be a laboratory for the investigation of biological problems and needs to be organized much as an institute of biology or physics or chemistry. Yet there is a very definite difference that never can be lost sight of. The hospital is peopled with patients that require all the diagnostic and therapeutic skill and the best of nursing care found in the leading hospitals of the land. The staff will need all the clinical acumen and judgment of the best of physicians and surgeons. Every problem should be so moulded that the humanity of the patient is the dominant idea which must determine and set the limits of methods of investigation. The ideal must be that nowhere will patients receive better care and a more highly organized service. The investigator, who in training and at heart is not a clinician, is out of place in such a hospital and most assuredly should not rank high in the scheme of organization. Problems, unconcerned with patients, had best be studied in the laboratories of pure science, not in the laboratories of the hospital. Workers in the hospital profitably can spend periods of study in other laboratories, and always there should be close contact with all members of the biological, physical and chemical institutes of the university. Such a hospital, not developed as an integral part of a university, will be greatly hampered in progress. In general terms I have just outlined my ideas of the second type of hospital. Its effectiveness will be measured, in large part, by its productivity in research.

It is of this second type that the Albert Merritt Billings Hospital proposes to be, and along these general lines it needs to be organized.

The University of Chicago, as I understand from various of its officials and professors, intends to try a great and on the whole a new experiment in medical education, in which this hospital will be an integral part, probably the most important part.

The purpose of this school will be to train, as the main product, medical investigators and medical teachers rather than practitioners. Medicine is to be a graduate department of the university rather than a professional school; organization and development will be determined to that end. The number of students is to be small and particularly selected as potentially capable of development into investigators and teachers. The methods are to be those of the graduate schools of our universities. At once numerous difficulties will confront the organizers of such a school.

The best method of selection of students is a serious problem. The success of your experiment will in large measure depend on its satisfactory solution. For some years now a number of medical schools have limited their student intake to those of particular collegiate training and of high rank. It must be confessed that no methods of selection, so far tried out, have proved to be very satisfactory. Our students of to-day certainly average better as the result of this selection, but many very mediocre men are admitted to all our schools, and many medical educators have grave doubts as to whether the number of really brilliant students in our classes has been much, if any, increased by our methods of selection. More important than this is our ignorance of how many we exclude who, if admitted, would have far excelled those actually chosen. You will need to find a better method of selection, or else your general scheme may be doomed to failure. Very likely you will in succession try and discard methods. Instead of small classes, a very large entering class, with subsequent reduction, may be necessary, or the development of some type of honors school within a larger school may be needed. It is not my place to suggest a method. Merely do I wish to point out that admission selection will be an important part of your experiment.

As already indicated, size of classes will be another problem. The very obvious advantages of small groups of students in close contact with teachers may not offset the stimulation of association with a large body of students and the reduced probability of brilliant graduates incident to small numbers.

Teaching methods present a different type of problem, as yet not satisfactorily solved in any of our schools. Great freedom to the individual student will be desirable, for genius thrives in the atmosphere of great opportunities, and yet there are limitations to this freedom in medicine not incident to

other graduate schools, for after all a very large proportion of your product will be either teachers of practitioners or practitioners themselves, and at least must be trained in the art as well as the science of medicine. As already pointed out, that part of your faculty concerned with the hospital must of necessity be skilled in the practice of medicine, capable of teaching its practical applications. Moreover, change in the medical curriculum has been rendered difficult by legislative fixation, an unfortunate result of the work of some of our standardizing bodies. All this renders difficult an experiment in medical pedagogy which includes great freedom to the individual student, and yet the way out must be found.

In these and many other directions your problems will be great, and how you solve them will be of the utmost importance to the medical world. Like any other experiment, an experiment in medical education will need careful preliminary planning, the ability to recognize defective methods and a readiness to speedily discard the ineffectual. Fluidity of plan is of prime importance for success. Preconceived ideas, too long adhered to, may easily spoil all chances of success. Outside influences must not be allowed to dominate the experiment. Your leaders will need high courage; the courage to go ahead with a well-conceived plan against the opposition of tradition, the greater courage to admit the failure of a pet theory and begin the trial of a new one, probably one evolved by another. It may even turn out that the entire idea of a rather small research hospital and a small body of carefully selected students will produce too few brilliant workers in medicine to justify the expenditures made, and there will be a return to the plan of a larger hospital and a larger student body, with especial opportunity for the particularly gifted of this larger group, for one must confess that there is much to indicate that the small school has not quite measured up to its expectations.

To your leader should be left great freedom in the determination of every phase of your organization. The academic freedom of the institution is as essential as that of the individual. So far academic freedom in experiments in medical education has been hampered by two things: lack of means to carry out necessary steps in the experiment, and lack of freedom to expend existing funds because of limitations set by donors. I know of no undertaking in medical education to-day not hampered by the one or the other of these factors. So I would say to all donors of funds to this undertaking of the University of Chicago: Place funds in great liberality at the disposal of those selected to carry out the project, but leave to them complete freedom in regard to all questions of method, organization and equipment. To your governing bodies equally would I say: Accept not the gift hampered by many conditions as to use. To say "No" to a donor may be the part of great wisdom; a wisdom too rarely shown by governing bodies of educational institutions. Those you select as leaders obviously will have been selected because of confidence in their judgment and ability. To place limitations on what they may do will be but an expression of suspicion and of lack of confidence that can but rankle and may mar the chances of success of your experiment.

In medical education of to-day the clinical departments are on far less sure a footing than the preclinical. For this reason the development of the Albert Merritt Billings Hospital in relation to teaching and investigation becomes the most essential factor in the success of your experiment in medical education and will be watched with scrutinizing, critical eyes. That you have voluntarily undertaken a very important problem all will recognize. Good wishes will follow you in the work. It would seem to your colleagues, scattered throughout this broad land of ours, that here on the shores of one of the Great Lakes, in a region in which the pioneer spirit is still felt, is a fitting place for such an experiment. May it not be that these waters that restlessly lap on the not far distant lake shore express the spirit needed by an institution of a new and untried type. Now tossed by a tempest brewed from dark and lowering clouds, again the incessant beat on the shore of waves generated by the winds of the passing storm, now dark and angry as in a winter's day with icy blast and clouds of driven snow, once more quiet and serene in the calm of a summer's day; such are the moods of the lake, ever changing, always varying, and yet constant, enduring, magnificent, a mighty force continually at work. From the changing activities of the lake with its reserve of enduring force may there come an inspiration and stimulation to this institution which as the years go by will lead it in the paths of progress to the ultimate attainment of its goal, the finished preparation of many leaders in all fields of medical education and medical investigation. To this end may this memorial endure, a lasting tribute to the memory of the name it bears—Albert Merritt Billings.

HENRY A. CHRISTIAN
PETER BENT BRIGHAM HOSPITAL,
BOSTON, MASS.

THE MEETING OF THE INTERNATIONAL ASTRONOMICAL UNION

THE second triennial meeting of the International Astronomical Union was held at Cambridge, England, from July 14 to July 22, 1925. The meeting was formally welcomed to Cambridge in the Senate House of the university on the afternoon of July 14. At that time the chancellor of the university, Lord Balfour, welcomed the delegates on behalf of the university; Dr. Jeans, on behalf of the Royal Society and the Royal Astronomical Society, and Sir Frank Dyson, the Astronomer Royal, on behalf of the Greenwich Observatory. The reply to the various addresses of welcome was given by the President of the Union, Dr. W. W. Campbell, president of the University of California.

The arrangements for the Cambridge meeting had been most admirably and efficiently handled by Professor A. Fowler, the general secretary of the union, and a local committee. Due to the energy and insistence of Professor Fowler, all the twenty-seven standing committees of the union had prepared full reports, and printed copies of these awaited the delegates. The local committee had arranged for the housing of the more than two hundred delegates and guests so that all were very comfortable. The delegates who were unaccompanied by ladies were the guests of the various colleges in Cambridge and were housed in the dormitories, while the others lived in various private homes and hotels in the town.

The social side of the meeting had been taken care of by the local committee. Evening receptions were tendered the delegates by St. John's College, Sidney Sussex College and Queen's College. A formal dinner was given in their honor by Trinity College, the college of Sir Isaac Newton. An afternoon reception was given by the vice-chancellor of the university, Professor A. C. Seward, of Downing College, and a garden party at the observatory by Professor and Mrs. Newall and Professor and Miss Eddington. Trips were arranged to visit the Ely Cathedral and the plant of the Cambridge Instrument Works. A meeting of the Cambridge Philosophical Society was held at which Sir J. J. Thompson spoke on the "Nature of Light" and Professor Eddington on the "Interior of a Star." A special meeting was held at which the various delegates were given the opportunity for showing lantern slides and briefly describing their individual fields of research. In connection with the meeting a special convocation of the university was held at which the honorary degree of Sc.D. was conferred upon Professors W .W. Campbell and Frank Schlesinger, of the United States; Professor de Sitter, of Holland; M. Baillaud, of the Paris Observatory; and Professor Nagaoka, of Japan.

The first session of the general assembly of the union was held in the Arts School on the morning of July 15. At this meeting Dr. Campbell delivered the presidential address. In this he emphasized the value of international cooperation in so far as it was necessary or useful. He also indicated that too much cooperation might be dangerous in that it might interfere with the initiative of individuals. He was very careful to assure the delegates that the union had no such cooperation in mind. A warning was given against the danger of the union entering lightly upon extensive programs which might involve a great deal of international cooperation and organization. In this connection Dr. Campbell pointed to the Astrographic Catalogue which was started nearly forty years ago and which, in spite of tremendous effort and sacrifice on the part of some of the participating observatories, is still far from complete due to the failure of certain nations to fulfil their obligations.

Following the opening address came the report of the executive committee in which Professor Fowler indicated the growth and progress of the union since the meeting in Rome in 1922. At the Cambridge meeting over two hundred delegates were present from twenty different nations, while at the Rome meeting only about half as many delegates represented fifteen countries. The new countries to be represented were Norway, Spain, Portugal and Switzerland, which have formally joined the union, and Sweden which has formally expressed the intention of joining.

After the report of the executive committee had been accepted a number of resolutions were introduced to the general assembly which indicated the more important questions that were to face the delegates. The first of these questions dealt with the complete internationalization of the union. All the delegates had hoped that the question relating to the admission of Germany and the central powers to the union would have been settled at the meeting of the International Research Council at Brussels, just previous to the meeting of the union. Since no action had been taken at Brussels it was at once evident that the union must act for itself. President Campbell very wisely deferred the consideration of this delicate question until after the delegates had had opportunity to talk the matter over informally. In this way it was felt that a decision might be reached which would both accomplish the desired end of complete internationalism and still would not impair the harmony and success of the present meeting.

A second important question facing the union was that occasioned by the recent change in the practice

of the various national ephemerides in commencing the astronomical day at midnight instead of at noon. This change has brought about great confusion in the publication of results by different astronomers. The discussion on this question, and the related one concerning the time of beginning of the Julian Day, was referred to a special committee under the chairmanship of Professor de Sitter.

After a short meeting of the general assembly on the morning of July 16, the various committees began their work on their reports. Since there were twenty-seven standing committees and four special committees appointed by the president to act upon the resolutions introduced at the first meeting of the general assembly, and since each one of these committees held from one to four meetings each lasting from one to three hours, it is obviously impossible to give anything approaching a complete account of their proceedings in this article. The complete reports will be published in the *Transactions* of the International Astronomical Union and will form a most valuable and complete summary of the work that has been done in the various fields of astronomy during the last three years. From the preliminary reports and recommendations of the various committees the following more important items have been gathered.

The committee on notations, units, etc., proposed several minor modifications of the list approved at the Rome meeting. The following units were adopted:

(1) Distance: (a) The kilometer for the sun, planets, etc.; (b) the astronomical unit for the solar system; (c) the light year for popular accounts of interstellar distances; (d) the parsec for scientific studies of interstellar distances.

(2) Absolute magnitude: The magnitude of a star at a distance of 10 parsecs.

(3) Heat: The Joule or, when more convenient, the calory.

(4) Wave length: The international angstrom (I.A.).

(5) Pressure: the bar = 10^6 dynes per square centimeter.

(6) System of units: The C.G.S. system.

A sub-committee of this committee was formed to consider the revision of the boundaries of the constellations with the view of eliminating some of the multiple names of stars. The changes of boundary are to be made so as to avoid the changing of the name of any known variable star.

A suggestion was forwarded by the committee on ephemerides to the various national ephemerides that the rectangular geocentric coordinates of the various observatories be published so as to include the altitude of the observatory.

The committee on bibliography expressed the immediate and fundamental need for a complete international bibliography of astronomy. They suggested that, until the complete scheme becomes possible, each nation prepare progressively and as rapidly as possible a catalogue of the astronomical works in its own publications.

In several committees the favorable opposition of Eros in 1930–31 was discussed and plans were made for the various observations. The committee on meridian astronomy reported that observatories at the Cape, in Germany, at Greenwich and at Washington were ready to cooperate in the observing of the position of comparison stars. The committee on minor planets, comets, etc., reported that steps had already been taken for the accurate determination of the path of Eros during the opposition.

The committee on solar physics recommended that a solar observatory be established in Japan to bridge the gap now existing between the Mt. Wilson and Kodaikanal Observatories. It was pointed out that such an observatory would make continuous observations of the sun possible.

The following Neon lines were adopted by the committee on wave lengths as secondary standards: $\lambda = 6929.466$, 7173.938, 7245.165 and 7535.785 I. A. An exact specification was also adopted for the construction of the lamp in the production of the primary standard cadmium line $\lambda = 6438.4696$ I. A.

The results of the recent observations made at the Mt. Wilson Observatory on the equatorial velocity of rotation of the sun were discussed in the report of the committee on solar rotation. It was pointed out that, while for the last five years the velocity had been very constant, there is a distinct drop in value over that found in the previous five years. Dr. St. John pointed out that such an effect might be produced by the change in the magnetic polarity of sun spots because this would influence to a considerable extent the currents in the upper atmosphere of the sun.

The committee on the physical observations of planets, comets, etc., recommended two types of observation. First they urged the micrometric observations of surface features of the planets and second that the photometric observations of the minor planets be increased. This committee also recommended the study of the spectrum of the eclipsed moon with the view of determining more regarding the character of the upper atmosphere of the earth.

The probable errors of longitudes as determined by wireless were carefully discussed by the committee on that subject. These errors appear to be so small that the committee felt justified in recommending a world-wide survey by this method.

The committee on the astrographic catalogue reported the progress made to date by the various cooperating observatories. The committee voted to send special requests to several observatories where progress has been slow urging the pressing of their share of the work to an early completion.

The reports of the committees on stellar photometry and variable stars contain lists of variable stars and discussions of methods of observing that will prove of inestimable value to any observers of variable stars.

The parallax committee reported the progress made in their field in the last three years and announced that three new twenty-four inch telescopes would soon be engaged in this work. The new instruments are the Yale instrument at Johannesburg and the telescopes at Lembang and at the Cape Observatory.

A new catalogue of nebulae and star clusters was urged as a fundamental need by the committee in this field of astronomy. Until such a catalogue is available all observers are urged to list objects under the N.G.C. or I.C. numbers.

The committee on stellar radial velocities announced that a catalogue of all stars with well-determined radial velocities would shortly be published. They appointed a sub-committee to prepare a catalogue of standards for radial velocity determinations. The stars in this catalogue are to be so selected that they will be all of thoroughly well-determined radial velocities and be so distributed that on any given half night at least one star of each spectral class will be available for observation.

At the meeting of the general assembly on July 21, the reports of the various standing committees were adopted with a minimum amount of discussion. It was realized that all the doubtful points in the various reports had been best settled in the long discussions in the small committee groups.

The special committee appointed at the first meeting of the general assembly to consider the vexing question concerning the designation of Greenwich time commencing at midnight reported that they could reach no definite agreement. They merely recommended that for the next three years astronomers reporting observations should be very careful and explicit in stating just what kind of time they were using. This committee did recommend that the Julian day be considered as beginning at noon, as was the case prior to the adoption of the recent changes in the various national ephemerides. This recommendation was adopted by the general assembly after considerable discussion.

Nearly every country represented at the meeting had prepared resolutions regarding the admission of Germany and the central powers to future meetings of the union and to membership on the various standing committees. It would be futile to give all these resolutions, but two of them may be of interest as representing the general opinion of the delegates. The American delegation stated that in their view the time had come when the removal of restrictions as to nationality were essential to the success of the union, and that they were not prepared to recommend the participation of astronomers from the United States in a future congress until the statutes permitted astronomers of all countries to take part. Belgium, France, Great Britain and several other nations subscribed to the opinion that the International Research Council should not block the admission of the central powers after they became members of the League of Nations. It was voted by the general assembly that copies of the various resolutions should be placed in the hands of Sir Frank Dyson, the representative of the union on the International Research Council, for transmission to that body.

Upon the nomination of the executive committee the following officers were elected:

President: (elected for a term of three years) Professor de Sitter of Holland.

Vice-presidents: (elected for a second term of three years), Professors Cerulli (Italy), Deslandres (France) and Hirayama (Japan).

Vice-presidents: (elected for a term of six years), Professors Schlesinger (United States) and Eddington (England).

General Secretary: Mr. F. J. M. Stratton (England).

The invitation of the Dutch government that the meetings for 1928 be held in Holland was conveyed to the general assembly by Professor de Sitter. This invitation was unanimously accepted by the general assembly.

After the adjournment of the meeting in Cambridge many of the delegates went to London to attend the various ceremonies in connection with the 250th anniversary of the founding of the Royal Observatory at Greenwich. Special meetings of the Royal Astronomical Society and the British Astronomical Association were held in honor of the visiting astronomers, as well as a special Conversazione of the Royal Society. At the time of the visitation of the Royal family to the Greenwich Observatory several astronomers were honored with presentation to the King and Queen.

The final trip arranged for the delegates was to Oxford University, where they were the guests of Professor Turner and the staff of the Radcliffe Observatory.

WARREN K. GREEN
AMHERST COLLEGE OBSERVATORY
NOVEMBER 1

JOHN MASON CLARKE[1]

DR. CLARKE was so delightfully human, so broad in his culture and interests, that we always looked forward to a visit from him with keen anticipation of enjoyment, and to the strengthening of the spirit of friendship and good fellowship. Out in the open, the inspiration of nature unsealed the floodgates of his thought, and there flowed forth a stream of logical reasoning and beautiful imagery, picturing the chapters of earth history so vividly that it lingered long in memory and fundamentally influenced the listener's conceptions of the development of the earth.

In the laboratory his thorough, systematic method of investigation of material gathered from three continents led to discussions and reasoning that clarified many moot questions, and when he had written out in classic diction his final conclusions, it was a pleasure to read and discuss them with him. After the day's work was over, a stroll out of doors in summer, or a seat before the fire in winter served to stimulate another side of his most agreeable and versatile nature. On such occasions, we would glimpse his philosophy of life and his keen interest in human affairs, as well as his undying loyalty to his native state and his ideals of what a scientific man should stand for. He believed that in addition to being an investigator he should be a good citizen, taking an active constructive part in the community in which he lived. He could not tolerate fraud, deception or sharp practice in any phase of scientific or other human affairs, and he did not hesitate to denounce in private and public any move on the part of communities or individuals that appeared to him to reflect on the people of the State of New York or their scientific and educational activities.

New York State owes to Dr. Clarke an eternal debt of gratitude for preserving the records of its scientific activities of ninety years or more, and for developing and carrying on, as a part of the educational system of the state, a museum unexcelled among state museums. James Hall, the founder of the museum and the great scientific leader of New York State for fifty years, died with the impression that there was no one who would take sufficient interest to carry it forward as an educational factor in the life of the oncoming generations of the people of the state. He did not fully realize that the young man who had been associated with him for years had all the qualities essential to successfully sustain the work of the world-renowned State Geological Survey, and the upbuilding of a model state museum. Dr. Clarke, by birth, training, ability and spirit, was the ideal successor of James Hall, and it is to the honor and credit of the Regents of the University that they recognized his ability and fitness for the task and assigned it to him. Dr. Clarke effectively carried on an important and valuable work, yet so quietly and modestly was it done that even those closely associated with him did not fully realize the contribution that he was making to science and to the reputation of the people of the state. His passing is a distinct loss to scientific interests in America, and to intelligent humanity throughout the world. The influence of such a personality extends through the medium of kindred minds to the men and women and to the boys and girls who are to be the future leaders and guardians of the material and spiritual welfare of the people of every nation.

His life and public service are a splendid illustration of the inestimable value of the right sort of early home influence, followed by cultural growth based on school and college training of a high order, and subsequent association with men and women of fine ideals and sense of duty. I wish that some one would write the simple story of his life, and that it might be made available to every student within the jurisdiction of the Regents of the University of the State of New York. He was a New York State boy, and a product of its system of education, from childhood until he laid down his responsibilities and passed on.

Dr. Clarke was my life-long friend and I am glad to take this opportunity to pay tribute to him. He was an exceptional man, a scientist of a high order of excellence, an unselfish, public-spirited citizen, and a humane, Christian gentleman.

CHARLES D. WALCOTT

[1] Address made at the sixty-first convocation of the University of the State of New York.

SCIENTIFIC EVENTS

AN OSLER MEMORIAL VOLUME

THE International Association of Medical Museums will shortly issue a memorial volume of appreciations, anecdotes and reminiscences of Sir William Osler by over a hundred colleagues, friends and pupils. The volume is prefaced by a foreword from Professor William H. Welch and a proëm by the late Sir Clifford Allbutt, followed by some 600 pages of memorial contributions, with over 60 engravings and half-tone illustrations. At the end, there is a complete reasoned bibliography of the writings of Osler, based upon the chronical bibliographies already published by Miss Minnie W. Blogg (Baltimore) and Dr. Maude E. Abbott (Montreal), followed by a bibliography of "Writings about Osler," and a list of advance subscribers. The Osler bibliography is as complete as the labor of several efficient collaborators could make it, and has been extensively annotated,

in accordance with Osler's expressed preference for "a combination of biography with bibliography," *viz.*: "To be of value to the full-fed students of to-day, a bibliography should be a catalogue raisonné, with judicious remarks and explanations." (1918.) The anecdotes, reminiscences and biographical notations in the memorial volume will thus supplement, in a manner, the Cushing biography, which has attracted such widespread interest among the laity as well as among the medical profession. The present edition of 1,500 volumes is supported by private advance subscriptions and by a publication fund, inaugurated in January, 1921, by initial contributions from the National Research Council (Washington), the late Sir Edmund Osler (Toronto) and others. Advance subscriptions ($10) may be made by check, made payable to the *International Association of Medical Museums* (*Osler Memorial Volume*) and addressed to Dr. Maude E. Abbott, permanent secretary, International Association of Museums, The Medical Museum, McGill University, Montreal, Canada.

A NEW WISCONSIN STATE PARK

BIOLOGISTS who seek suitable territory for out-of-doors summer research would do well to investigate the possibilities of the newly created Northern Forest Park in Vilas county, Wisconsin. This new game refuge, containing approximately 92,000 acres, 76,000 of which are state owned, lies nearly in the heart of the "land-o'-lakes" country of northern Wisconsin, one of the most attractive areas in the middle west. It is a country of forests, lakes, rivers and swamps, abundant in wild life. The forests are mostly second growth, but the trees are of large size, and the shrubs and wild flowers plentiful. Fire has not marred the country for many years, and the vegetation is in consequence luxuriant. Animal life is abundant, varying in size from protozoa to black bear. The lakes, all alive with fish, are mostly of the Manitowish system, and number over forty. In size they range from Trout lake down to sphagnum encircled ponds, all having an astonishing assortment of aquatic life. A few of the larger lakes have been surveyed by Juday (Bull. XXVII, Wis. Geol. & Nat. Hist. Surv.) from whom the accompanying data are taken.

From the point of view of the scientist, the new park is particularly happily situated. Auto roads transect the region, and it is pierced by the Chicago, Milwaukee & St. Paul railroad, with trains stopping at Sayner (15 hours from Chicago), the only town in the park. Hotel accommodations are plentiful and well scattered, and for those who would camp out, 76,000 acres are available. For aquatic investigations facilities are especially good. Boats may be rented on almost any lake, and out-board motors are usually

Lake	Length Miles	Area Acres	Max. Depth: Feet
Trout	4.50	4,160	115.0
Star	2.12	1,152	26.2
Plum	4.20	1,088	50.8
White Sand	1.65	793	67.2
Laura	1.50	640	39.4
Ballard	1.50	537	16.4
Clear	1.75	505	26.2
Upper Gresham	1.25	358	26.2
Razor-back	1.10	352	31.1
Allequaw	1.50	352	24.6
Diamond	.70	76	29.5

available. Those who would carry on deep water dredging or bottom fauna investigations will find to their advantage that Mr. Bert Warner, of Forest Home resort on Plum lake, has a large, heavy launch admirably adapted to this kind of work. Local electric light plants at many of the resorts make microscope work possible. As the waters of the region are unpolluted, the conditions are admirable for a study of the smaller aquatic organisms. The writer has been over the territory involved many times and will gladly furnish any information, as will the Wisconsin conservation commission at Madison.

ALVIN R. CAHN
ZOOLOGICAL LABORATORY,
UNIVERSITY OF ILLINOIS, URBANA

THE COMMITTEE OF ONE HUNDRED OF THE AMERICAN ASSOCIATION

As was announced in an earlier number of SCIENCE, it was resolved at the Washington meeting of the American Association for the Advancement of Science to reorganize the Committee of One Hundred on Research, a body that was in active operation before the war. This committee was merged at that time with other agencies in the synthesis out of which grew the National Research Council. It was felt that the field occupied by the Research Council still left important work for the American Association to do. The Research Council has devoted itself broadly to the securing of support for research projects. The reorganization of the Committee of One Hundred has been practically completed and a program of work has been developed in connection with the organization of several active subcommittees. This program concerns itself not so much with definite scientific problems to be investigated as with the broader questions dealing with the conditions of the research. Rather those factors and influences that aid or limit the researcher are to become themselves objects of careful attention.

Until the subcommittees are completely organized and have had time to undertake their investigations, the Committee of One Hundred can report only organization information. However, the executive committee of the American Association has considered and approved the plan for the presentation of a number of addresses at the Kansas City meeting in which some of the problems at present affecting the success of research will be dealt with from several points of view.

This program will be presented in an auditorium, to be announced later, at 2:30 o'clock on Thursday afternoon, December 31. It is expected that President Pupin will preside.

Dr. William MacDonald, of New York, the well-known historian and author, will speak on "The Intellectual Worker and his Work." Dr. MacDonald has been giving close personal attention to the status of intellectual workers since the great war, and in his book (Macmillan, 1923) bearing the above title, has dealt with conditions found by him to exist in Europe. Dean Byron Cummings, the distinguished archeologist, of the University of Arizona, in an address on "Problems of the Scientific Worker" will discuss some phases of the present status of the American researcher and deal with conditions that affect his success. Dr. Frank E. E. Germann, of the department of physical chemistry at the Colorado School of Mines, will speak on "Cooperation among College and University Workers." At the present time, the importance of united effort whether in prosecuting complicated scientific investigations or in securing conditions favorable to the development of science, is generally conceded.

It is hoped that this program may contribute to the interest that is felt to be necessary to the successful prosecution of the work of the Committee of One Hundred on Research.

RODNEY H. TRUE,
Secretary

THE NEW VISITING PROFESSORSHIP OF CHEMISTRY AT CORNELL UNIVERSITY

AS was announced in a recent number of SCIENCE, Cornell University has received an anonymous gift of $250,000, the income of which is to be used by the university for the benefit and advancement of teaching and research in chemistry and allied fields. The gift is made to enable the university to carry out a plan formulated by Professor L. M. Dennis, head of the department of chemistry. Under this plan the university will invite eminent men of science to come to Cornell, each for one or two semesters, to present the most recent advances and the methods and results of their own investigations in the branches in which they have won distinction. The endowment provides for the printing of the lectures, and these publications will form a series of authoritative monographs of peculiar interest and value.

Professor Ernst Cohen, professor of physical and inorganic chemistry in the van't Hoff Laboratory at the University of Utrecht, Holland, who will be the first to lecture on this foundation, will be in residence at Cornell during the second semester of this academic year, from February 1 till June 1, 1926.

The lectures on this foundation will always be open to members of the staffs of instruction of sister institutions, and they are cordially invited to avail themselves of the opportunities thus afforded. A private research laboratory will be put at the disposal of each non-resident lecturer, who will thus be enabled to instruct a limited number of qualified students in methods of outlining and carrying on investigations in his special field. It is planned to choose the lecturers so that different branches of chemistry and of allied sciences will be represented from term to term.

Persons familiar with modern advances in chemical science and particularly in physical chemistry, will at once recognize the significance of Professor Cohen's visit to America. He is the author of many books and pamphlets comprising lectures and texts in the fields of inorganic and physical chemistry for the use of physicians and biologists, and of biographical studies of several distinguished scientists, including his famous predecessor, the late J. H. van't Hoff.

The original investigations of Professor Cohen and his co-workers cover a wide range of topics along the lines of thermodynamics, thermochemistry, electrochemistry, piezochemistry, and other branches within the fields of physical and inorganic chemistry. Their results have been published in some two hundred articles in the leading Dutch, French, German and English scientific periodicals. Professor Cohen's researches upon metastable and allotropic forms of the elements have attracted particularly wide attention.

Professor Cohen is this year president of the International Union of Pure and Applied Chemistry, which will meet in this country next summer.

SCIENTIFIC NOTES AND NEWS

AMONG the general lectures arranged for the Kansas City meeting of the American Association for the Advancement of Science is a lecture by Dr. R. A. Millikan, of the California Institute, on "The Stripped Atom."

DR. HARRIS J. RYAN, professor of electrical engineering at Stanford University, has been awarded the Edison medal for the year 1925 by the Edison medal committee of the American Institute of Electrical Engineers "for his contributions to the science and the art of high-tension transmission of power."

DR. CHARLES MAYO has been made an officer of the Legion of Honor by the French government.

DR. A. C. NOÉ, associate professor of paleobotany at the University of Chicago, has received a number of recognitions for relief work done in Austria, including the golden decoration of honor from the Austrian government, the golden medal of honor from the University of Vienna, the honorary Ph.D. degree from Graz and honorary membership in the University of Innsbruck.

A DINNER in honor of Dr. Dean Lewis, recently appointed professor of surgery at the Johns Hopkins University and surgeon in chief to the Johns Hopkins Hospital, Baltimore, has been arranged for January 22, 1926. The surgical alumni of Johns Hopkins and leading surgeons from other parts of the country have been invited. There will be a series of clinics, and in the course of these meetings a movement will be started to create an organization to be known as the Johns Hopkins Surgical Society.

DR. JOSEPH V. DE PORTE, director of the division of vital statistics of the New York State Department of Health, has recently been elected to fellowship in the Royal Statistical Society of England.

THE second Röntgen award of the Röntgen Society, of England, has been made to Dr. Robert Knox for his paper entitled "The Investigation of the Movements of the Heart by the Use of the Slit Diaphragm and the Moving Film," which he read before the society during the course of the past session.

THE engineer, Dr. G. Schmaltz, has recently been made an honorary doctor of medicine at the Frankfort Medical Faculty for his work on the physiology of the labyrinth.

THE honorary gold medal of the faculty of the University of Hamburg was awarded at the recent silver jubilee of the Institute for Ship and Tropical Diseases to Professors Aráoz Alfaro and Castex, of Buenos Aires; Gómez, the president of Venezuela; Dr. Münnich, of Valparaiso, and Professor Mingazzini, of Rome. An honorary degree was conferred on Professor Giemsa, of Hamburg.

PROFESSOR LISE MEITNER, member of the division of chemistry of the Kaiser-Wilhelm Institute in Berlin, has been awarded the Lieben prize of the Vienna Academy of Sciences.

JOSEPH BLAYAC, professor of geology at the University of Montpellier, has been made an officer of the Legion of Honor by the French government.

A FUND is being collected in tribute to Dr. Charles Richet, Paris, on the occasion of his seventy-fifth birthday.

PROFESSOR LUDWIG RADLKOFER, director of the Munich Botanical Museum, has celebrated the seventieth anniversary of his doctorate. He is now ninety-seven years of age.

PROFESSOR RICHARD HERTWIG, the distinguished zoologist, celebrated his seventy-fifth birthday in Munich, on September 23.

M. PAUL PAINLEVÉ has been appointed to succeed M. Henri Bergson as president of the Commission for Intellectual Cooperation and Professor Rocca, of the University of Rome, to succeed Senator Ruffini in that body.

AT a recent meeting of the executive committee of Science Service, Inc., Dr. J. McKeen Cattell was elected chairman of the executive committee and vice-president; Dr. Vernon Kellogg, permanent secretary of the National Research Council, Washington, was elected treasurer, and James Stokley was elected assistant treasurer.

AT the annual meeting of the Geological Society of Washington on December 9 the following officers were elected for the ensuing year: N. H. Darton, *president;* W. T. Lee and Chas. Butts, *vice-presidents;* J. D. Sears and W. P. Woodring, *secretaries,* and J. B. Reeside, Jr., *treasurer.*

DR. WILLIAM B. KOUWENHOVEN, associate professor of electrical engineering at the Johns Hopkins University, has been appointed by the U. S. Department of Commerce as engineer at large on a committee for the standardization of dry cells and electric batteries, according to a recent announcement by Herbert Hoover, secretary of commerce.

GEORGE F. BARNWELL, former instructor in geology at the School of Mines and Metallurgy at Rolla, Mo., has resigned to go to Java as geologist with the Standard Oil Company. L. W. Currier has taken Mr. Barnwell's place at the School of Mines and Metallurgy.

DR. G. N. VORONOFF, head of the Russian Scientific Expedition to South America, recently passed through the United States on his way to the north coast of Colombia. For the present, botanical exploration will be confined chiefly to the mountainous region of eastern Colombia.

THE Powell lectures in psychology at Clark University have been given as follows: On December 10 and 11 two lectures by Professor William McDougall, of Harvard University, entitled "Men or Robots," and on December 12 a lecture by Professor Robert S. Woodworth, of Columbia University, on "Dynamic Psychology."

AT a joint meeting of the Pennsylvania State College branch of the American Association for the Advancement of Science and the Gamma Sigma Delta Agricultural Fraternity, held on December 4 at the Pennsylvania State College, Dr. Oscar Riddle, of the Carnegie Station for Experimental Evolution, Long Island, N. Y., gave an illustrated lecture on "Metabolism and the Newer Aspects of the Sex Problem."

DR. F. G. COTTRELL, director of the Fixed Nitrogen Laboratory in Washington, delivered a lecture on "The Fixation of Nitrogen," on November 24, in the school of chemistry at the University of Minnesota. This was the first of the series of lectures to be held under the auspices of the school of chemistry for the current academic year.

DR. WILLIAM H. DALL, of the U. S. National Museum, addressed the 928th meeting of the Philosophical Society of Washington, on December 12, on "Some Recollections of the Founding of the Philosophical Society."

PROFESSOR WILLIAM SEIFRIZ, of the department of botany at the University of Pennsylvania, spoke on December 11, before the biological seminary at Princeton University, on "Oocyte Papillae and Protoplasmic Structure."

PROFESSOR JAMES KENDALL, of the department of chemistry of Columbia University, delivered a lecture on "The Rare Earths" at the School of Chemistry of the University of Minnesota, at Minneapolis, on December 1. On December 5 he spoke on the same topic before a joint meeting of the New England Association of Chemistry Teachers, the Chemistry Teachers' Club of New York City, and the New Haven Section of the American Chemical Society at Bridgeport, Conn.

PROFESSOR DOUGLAS JOHNSON, of Columbia University, recently addressed the officers of the United States Army War College, at Washington, D. C., on the subject: "The Military Geography of the Northeastern United States." On December 5 he delivered an address before the Colgate University chapter of Phi Beta Kappa on the occasion of the annual initiation and dinner, taking as his subject "The Evolution of the Grand Canyon Region."

DR. JAMES F. KEMP, professor of geology at Columbia University, recently delivered a series of four lectures to students of the School of Mines and Metallurgy, at Rolla, Mo. Dr. Kemp's subjects were: "A Summer in Wyoming," "Modern Trends in the Mining Industry," "The Development of the Anticlinal Theory" and "The Bingham Litigation."

ON December 5, Colonel C. H. Birdseye, chief of the topographical branch of the U. S. Geological Survey, delivered an address before the Royal Canadian Institute on the subject "Surveying the Grand Canyon of the Colorado."

DR. VLADIMIR ÚLEHLA, professor of plant physiology, Masaryk University, Czechoslovakia, gave a lecture on "Movements of Plants," on December 8, before the McGill University Chapter of Sigma Xi. The lecture was illustrated by a motion picture of the twining movements of *Pharbitis hispida*.

A MEMORIAL to the anatomist, John Irvine Hunter, whose untimely death was a great loss to science, has been arranged in Australia. A fund has been subscribed with six objects. The first is to have a portrait of Hunter painted which is to be displayed in the great hall of the University of Sydney. The second is to place a bust of Hunter in the medical school of the university. The third is to establish an annual oration on some subject embodying the results of original research and award a medal. The fourth is to institute a library. The fifth is to establish a laboratory for clinical research, to be known as the John Irvine Hunter Research Laboratory. Finally, it is proposed that annual scholarships will be offered to research workers in the laboratory.

A PORTRAIT of John Burroughs, painted by the late Princess Lwoff and presented to the American Museum of Natural History by Mrs. David C. Cook, of Chicago, has been placed on exhibition in the museum.

DR. RICHARD DANA BELL, assistant professor of biological chemistry at the Harvard Medical School, died on December 6, aged thirty-eight years.

DR. ALBION WALTER HEWLETT, professor of medicine at Stanford University, died on November 10, aged fifty-one years.

PROFESSOR JEAN MASSART, of the department of botany at the University of Brussels, recently died at the age of sixty years.

THE second annual dinner of the New York Alumni of Sigma Xi was held at the Faculty Club of Columbia University on December 14. The program was divided into two parts. The first part was taken up with a discussion of the responsibility of scientists in disseminating scientific knowledge to the public. The following four speakers discussed this subject from the angles of their respective fields: D. S. Kimball (engineer), dean of the college of engineering, Cornell University; Otis W. Caldwell (biologist), director of the Lincoln School, Columbia University; Franklin H. Giddings (sociologist), professor of sociology and the history of civilization, Columbia University, and Watson Davis, managing editor of "Science Service." The second part of the program

consisted of an experimental demonstration of recent advances in contemporary physics, by the physics department of Columbia University.

THE members of Sigma Xi resident in Rochester, N. Y., organized a local club the evening of December 2. Of fifty members in the city thirty-two attended the dinner and conference, held in the Faculty Club of the university. An address was given by the guest of the meeting, Dr. Liberty Hyde Bailey. Professor J. R. Murlin was made chairman of the club and Professor H. L. Alling the secretary-treasurer.

THIRTY-NINE geologists of Oklahoma, Kansas and Texas participated in a field conference held in southwestern Oklahoma from November 28 to December 4, this being the third of a series of similar conferences which have been held to study problems connected with the Permian rocks of the three states. It is planned to hold a fourth conference in northern Oklahoma within the next few months. The party gathered at the Artesian Hotel, Sulphur, Okla., and made a brief study of Platt National Park, being accompanied by Superintendent W. E. Branch, of the Park Service. Studies were made along the Anadarko Basin and the type locality of the Cloud Chief gypsum at Cloud Chief, Oklahoma, was visited. The trip also included a visit to Cedartop Mound and a study of the Channel sandstone near Dozier, Collingsworth County, Texas.

THE nations which are members of the World Power Conference have been invited to be represented at a sectional meeting in September of next year, in connection with the International Waterways and Hydraulic Power Exhibition, England. The agenda includes discussions on the application of electricity to agriculture, the electrification of railways, and the exchange of electric power between different countries.

ACCORDING to *Nature*, the fifth International Congress on Genetics will be held in Berlin during the latter half of September, 1927. At the fourth conference in Paris, in 1911, a meeting in Berlin was planned for 1916. The invitation, which now comes from the German Society for the Study of Heredity, has been unanimously accepted by the six surviving members of the international committee appointed by the Paris conference. The arrangements are in the hands of Professor E. Bauer, president of the German Society, with whom are associated Professors Correns, Goldschmidt, Hartmann and Nachtsheim.

THE Medical Research Council of England is having a new laboratory built at Millhill, Middlesex, for the use of Dr. W. E. Gye and J. E. Barnard in their studies of cancer. It is expected that the building will be finished by next March, at which time the two investigators, who at present often are working five miles apart, will be able to continue their experiments together under greatly improved conditions and with a larger staff of assistants.

HARVEY HADDEN, of London, has contributed £1,000 to the endowment fund of the James Mackenzie Institute for Clinical Research, St. Andrews. The county of Perth has contributed £7,500 as a tribute to the late Sir James Mackenzie, the founder of the institute, who was born in that county.

WE learn from the *Journal* of the American Medical Association that the Japanese government granted for the present fiscal year 65,000 yen to encourage scientific research, and this amount has been awarded by the department of education to one hundred and fifty research workers in governmental schools, private colleges, special schools and institutes. The amount of the subsidy formerly, previous to the adoption of a retrenchment policy by the government, was more than 120,000 yen. Among the persons to whom awards were made are: Professor S. Okada, for "Studies on Basal Metabolism and Nourishment"; Professor T. Nagayama, "Studies on Vitamin C"; Professor M. Yoshioka, "Studies on Immunology"; Professor G. Hiramitsu, "Histologic Studies on Nervous System with special reference to Intellectual Development"; Professor I. Matsuo, "On the Function of the Liver," and Professor I. Tagaki, "Prophylaxis of Typhoid Fever and Dysentery with reference to Food and Drink."

THE *British Medical Journal* states that the extensions to the department of physiology at King's College, London, have now been completed and were formally opened on November 6 by Professor W. D. Halliburton, F.R.S., emeritus professor of physiology in the University of London. A reception was given in the new laboratories at which were present many well-known physiologists and biologists. The new building will provide facilities for experimental research, for the teaching of advanced practical mammalian physiology and a professor's room. Further, the rooms formerly occupied by the bacteriology department have been taken over for biochemistry, for the provision of animal and polarimeter rooms and for a staff room and library. The reception was followed by a public inaugural lecture, entitled "Science and Culture," by Julian Huxley, who has recently been appointed to the chair of zoology at King's College in succession to the late Professor Arthur Dendy, F.R.S.

THE following is a translation of resolutions numbers 3 and 4, passed by commission No. 19, variation

of latitude, at the meeting of the International Astronomical Union, Cambridge, England, July, 1925. (3) The International Astronomical Union, assembled in congress at Cambridge (July 14–22, 1925), thanks the superintendent of the Coast and Geodetic Survey of the United States of America for his efforts towards the reestablishment of the latitude station at Gaithersburg (U. S. A.) and hopes that he will continue his efforts because of the very great importance of the resumption of observations at that station. (4) The International Astronomical Union, assembled in congress at Cambridge (July 14–22, 1925), thanks the superintendent of the Coast and Geodetic Survey of the United States of America for his efforts which established Ukiah as a permanent latitude station, under the direction of the Coast and Geodetic Survey.

THE council of the British Institution of Civil Engineers has made the following awards for the session 1924–1925 in respect of selected engineering papers, published without discussion: A Telford Gold Medal to Dr. Andrew Robertson (Bristol); a Telford Gold Medal and the Indian Premium to Mr. S. A. S. Bunting (Bombay); Telford Premiums to Messrs. A. D. Swan (Montreal), C. H. Cruttwell (New Ferry), J. W. McLaren (Newfoundland) and J. L. Hodgson (Eggington), and a Webb Prize to Mr. A. R. Johnson (Penang); and in respect of papers read at students' meetings in London or by students before meetings of local associations during the same session: The James Forrest Medal and a Miller Prize to Mr. E. J. Rang (Tynemouth), and Miller Prizes to Messrs. D. Lloyd (Liverpool), H. F. Lea (Birmingham), H. A. Macnab (Glasgow), T. W. March (Rochester), C. R. Smith (Manchester) and W. C. Knill (Gateshead-on-Tyne).

A NEW Micronesian-Polynesian Hall, containing one of the most extensive collections from those two Pacific island regions in existence, was opened by the Field Museum of Natural History on November 2. The hall includes a large Maori collection presented by Arthur B. Jones, a Fiji collection made by A. B. Lewis, assistant curator of Melanesian ethnology while on a Joseph N. Field expedition in the South Seas, and several collections purchased by the museum. It is on the ground floor of the museum just off the Egyptian Hall. Outstanding in the hall is a great Maori council house from New Zealand, 60 feet long, 20 feet wide and 14 feet high on the inside. It is probably the largest thing of its kind in any museum, and is one of the less than a dozen such houses in existence. The house, once used by the chiefs of a powerful tribe, is hand-carved and painted inside and out.

THE American Museum of Natural History, in cooperation with the commission of the Interstate Palisades Park, conducted this summer an interesting and successful experiment in out-of-door education under the direction of Dr. Frank E. Lutz. "Nature trails" were opened to the public in the Harriman State Park near Tuxedo, N. Y. One was a "training trail" along which were labels that did more than merely give the names of things; it was as though "a friend somewhat versed in natural history were taking a walk with you and pointing out interesting things along the way." On the other, the "testing trail," were merely numbered questions about the trees, shrubs and other things. Visitors were invited to test their knowledge and were scored according to the correct answers on file at the station for the study of insects, in connection with which this work was done.

ACCORDING to *Industrial and Engineering Chemistry*, at the September meeting of the Philadelphia section of the American Chemical Society, Dr. Walter T. Taggart, who is chairman of the committee to arrange for the September, 1926, meeting of the American Chemical Society in Philadelphia, outlined some features that had already been prepared for the comfort of the society. The meeting will be held from September 6 to September 10, and promises to be the largest meeting that the American Chemical Society has ever held. Besides being the fiftieth anniversary of the founding of the American Chemical Society, it will be held in connection with the Sesqui-Centennial Exhibition in Philadelphia, and will be followed by the International Congress of Pure and Applied Chemistry in Washington, D. C., one week later.

UNIVERSITY AND EDUCATIONAL NOTES

THE department of biological chemistry at the Harvard Medical School will receive $100,000 under the terms of the will of Dr. Richard D. Bell, who was assistant professor in the department.

THE General Education Board, of New York, has given the sum of $700,000 to the University of Virginia School of Medicine, which is half the amount needed for the erection and equipment of the new buildings planned. The gift is conditional upon the appropriation of $250,000 by the state and the raising of $450,000 by the university.

PLANS for a new pharmacy building at the University of Illinois, to be erected at Champaign at a cost of $375,000, have been approved by the university trustees.

PROFESSOR JOHN A. ALDRICH, formerly of Washburn College, Kansas, has been appointed professor of physics and astronomy at Oglethorpe University in Georgia. He succeeds John W. West, who last spring

was appointed president of North Georgia Agricultural College at Dahlonega.

DR. GEORGE A. BAITSELL has been promoted to an associate professorship of biology at Yale University.

DR. MARGARET L. CAMMACK, instructor in biochemistry at Columbia University, has been appointed associate professor of home economics at the University of Arizona. Dr. Cammack will have charge of nutrition work.

DR. EDWARD P. PHELPS, formerly of Cornell University, has been appointed associate professor of chemistry at Marshall College.

DR. CARL R. FELLERS, associate professor of food preservation at the University of Washington, has been appointed research professor of horticultural products at the Massachusetts Agricultural College and Experiment Station.

DR. H. ROGERS, professor of experimental pathology at the University of Paris, has been appointed to the chair of physiology in the university.

DISCUSSION AND CORRESPONDENCE

THE MUSIC OF THE AMERICAN INDIANS

A RECENT article in SCIENCE directed attention to the similarity of Chinese and Indian languages. Certain peculiarities of the music of the American Indians may be interesting in this connection. The peculiarities were observed among the Papago and Makah, in my study of Indian music for the Bureau of American Ethnology, and resemble the music of certain regions of Europe and Africa. Three of these unusual peculiarities will be described.

Among the Papago of southern Arizona I heard a high *drone* sung by two or three women, during part of a song. The occasion was a dance held by the Indians on Christmas night, more than seventy miles from a town and near the Mexican border. When recording songs among the Makah on Cape Flattery I asked whether they used this drone. The reply was: "Makah women sometimes sing the drone if they are not sure of a song and are asked to help in the singing, but the Quileute women do it a great deal and call it the 'metal pitch' because it is like a piece of metal which can give only one pitch." George Kennan noted this drone and wrote of it as follows: "In some parts of European Russia, and all over the eastern Caucasus, in the wild recesses of the mountains where the native music had not felt the modifying influence of European culture, I heard songs with this peculiar droning accompaniment." He states that the drone was usually the initial tone of the melody and suggests that it may have been sustained in order to enable the singers to return to the original pitch when repeating the song. A further suggestion is that the drone of the bagpipe may have been an imitation of the vocal drone. Among the American Indian tribes cited the drone appeared to be an embellishment to the singing and the ability to give it was regarded as a musical accomplishment. So far as known, this peculiarity has not been noted by other students of Indian music, and I have not found it among other than these tribes. Inquiry has not been made among the Indians of California. If they also have the drone, and if it reduces in importance from the north toward the south, this peculiarity may have an interesting bearing upon the migration of early Americans.

A resemblance was found between certain very old Papago songs and certain Arab songs which I obtained from Arabs of the Sahara Desert who were temporarily in this country with a Garden of Allah company. The resemblance was noted between songs of the desert journeying of Elder Brother (Montezuma) and the songs of the Arabs when travelling across the desert on their camels, loaded with bags of coffee. These groups of songs have a peculiar swaying rhythm in a slow tempo, difficult to describe but different from other melodies and strongly contrasted with songs of other tribes. Is this a similar reaction to the environment?

A curious resemblance between a custom of the Yogi in India a tradition of the Papago was found in the description of a song. It was said that Elder Brother and his people went to the place now known as Casa Grande, drove out the former inhabitants and tore down their houses. A man named Sivarimaha and his daughter lived in the structure known as the Casa Grande ruin. When Elder Brother came to that place he found the man on top of his house, standing on one foot with the other foot on his knee. It was believed that the man had some mysterious power and that he could not be killed while he remained in that position. His daughter stood on both feet. The death of the man was accomplished by means of a song. In the Yoga philosophy, before students undertake the "Asana positions," they are taught fourteen postures for balancing the body. The first posture requires the student to lift up the right foot with the left hand and stand on the left foot. Later he assumes the posture without the aid of the hand. Is it possible that beneath this narrative there lay, originally, an idea that the contradictory rhythm of the song destroyed the power given the man by his posture?

In the rhythmic songs of the Indian medicine men when treating the sick we find a coincidence with the mantras concerning which it is said (in the Yoga philosophy): "They are combinations of letters producing a sound, and that sound has a certain rhythmic

vibration which is reflected in the body. . . . The Greeks and Romans also knew of the power of words in this respect."

The music of any people is more than their melodies. It preserves many beliefs and customs that would otherwise be lost. In this lies the field of cooperation between the study of primitive music and other branches of ethnology.

Frances Densmore

Red Wing, Minnesota

A METHOD OF ESTIMATING POST-GLACIAL TIME

Among the problems met in the study of the Post-Pleistocene is one concerning the time period involved. The solution of the problem is important in many ways. Geologists are more keenly aware of the events which have occurred in this period than in any other. Hence close estimates of the length of time involved will contribute to a more accurate geological conception of the absolute rapidity of various physiographic processes.

Several estimates of the length of post-glacial time are commonly known. Taylor,[1] following Lyell, Spencer and others, estimated the period occupied on the recession of Niagara Falls. DeGeer[2] reached his conclusions from his studies of varied clays. Other estimates have been based on the erosion of the pedestals beneath erratics and on the comparative weathering of drift materials of different ages. The variation in these estimates emphasizes the importance of additional methods of calculating the Post-Pleistocene time interval.

At Yellow Springs, Ohio, there is located a chalybeate spring which has built at its point of issuance in the Cedarville (Niagaran) limestone a large mound of ferriferous travertine which extends some hundred yards into the Yellow Springs Creek valley. The valley lies nearly north and south and is located within the most extended moraines of the Wisconsin glaciation; not, however, within the terminal moraines of the last Wisconsin invasion. The ice moved from a northwesterly direction; the deposit is located on the east side of the valley—hence, it is reasonable to suppose that any preglacial deposit would have been removed by ice abrasion. The erosion by the enlarged streams from the melting ice, one of which occupied the valley, undoubtedly aided in eliminating previous and contemporaneous travertine deposits.

Theoretically, the volume of the present deposit divided by the rate of accumulation should yield the length of time of accumulation as a quotient. The method, as will be readily recognized, involves several complex factors, chief of which are variations in spring flow and in amount of solid material deposited, each influenced in turn by rainfall, temperature and variations in the subsurface spring channels.

Accurate observations extended over a considerable period of rainfall, spring flow, air and water temperatures, together with studies of the differences in quantity of solids in solution at different points within the area of deposition, should provide a basis for a reasonable estimate of the present rate of deposition. A careful collection of the encrusted vegetation should provide an index of climatic variation, which in turn influenced the rate of deposition in the past.

A detailed instrumental survey of the bedrock structure has already revealed the presence of a small flexure, or possibly a fault, which undoubtedly explains the location of the spring and leads also to the conclusion that the spring has been relatively permanent.

The first estimates of the age of the Yellow Spring travertine mound must be regarded as purely tentative. The figures obtained, namely 20,000 to 30,000 years, are intermediate between those given by Taylor and DeGeer. Since trustworthy results of the study of the spring deposit must await the passing of some months, and possibly years, of observation it seemed worth while to publish this method of estimating post-glacial time. It is undoubtedly applicable to many similar travertine deposits. The study of a number of them, in various situations relative to morainal deposits, should contribute materially to the knowledge of the length of the Recent epoch.

A. C. Swinnerton

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[1] Taylor, F. B., Niagara Falls Folio, United States Geological Survey Folio, No. 190, 1913.

[2] DeGeer, Gerard, "A geochronology of the last 12,000 years," Cong. Int. Geol. Compte Rendu, XI, 1910, pp. 241–253, 1912.

LUMINESCENCE IN SPONGES

Cases of luminescence in sponges have several times been recorded. Noll (*Zool. Anz.*, 1879, p. 402) described luminescent larvae of *Reniera*, which had been reared in a table aquarium. The light was manifested upon a slight mechanical disturbance in the water of the aquarium. He states that the light is produced by a luminous fluid accumulated in the body of the larva, but the observation is too crude to be of much value. Since the aquarium had contained several other animal organisms, such as annelids, crabs, etc., and at the same time, it is quite doubtful if the luminous larvae really belong to the sponge. Pagenstecher (*Allg. Zool.*, Bd. 4, 1881, p. 14) and Peron

(s. *Mongold*, 1910, p. 245) also described luminosity in sponges. Dahlgren (*J. Franklin Inst.*, 1916, p. 243) examined luminous sponges at Naples and proved that the worms and protozoa living in their canals were the actual source of the light. The matter is, however, different in *Grantia* sp. as observed by Harvey (*Biol. Bull.*, 1921, p. 286) at Friday Harbor. According to this author the sponge produces a good luminescence in the dark and gives a luminous slime when squeezed. The organisms living in its canals are not luminous. Harvey is of the opinion that the light of this species of sponge is an autogenous luminescence. Thus, there is uncertainty and diversity of statement as to the fact and the probable source of the luminosity in sponges, and we lack careful observation and study affording either positive or negative evidence on the subject.

In the evening of August 25, 1919, the writer, while engaged in examining the dredgings from the bottom of the Sagami Sea at a depth of about one thousand meters, observed a large specimen of *Crateromorpha meyeri* Gray to be brightly luminous. The whole body of the sponge glowed for several hours after being brought into a dark room. The luminescence consisted of a thousand spots of a blue light resembling the stars in the sky. On dipping the sponge into fresh water the light shone particularly brightly, but at the same time the luminous spots were observed to be transferred from the body of the sponge into the surrounding medium. Each spot proved to be a small annelid belonging to the family *Alciopinae*. More closely examined, the sponge itself showed numerous individuals of this same annelid filling the entire canal system. After the annelids were entirely removed the sponge gave no more light, while the removed organisms themselves glowed momentarily on stimulation. The light of *Crateromorpha* is apparently a secondary luminescence.

Whether or not other luminous sponges are analogous to this is an open question, but it is a usual feature that annelids and other small organisms live in their canals. I am inclined to believe that sponges do not produce autogenous luminescence.

Yô K. OKADA

PARIS, FRANCE

THE FAMILY CLIONIDAE

THE name Clionidae was adopted by Topsent in 1887 for a family of sponges which bore into the shells of molluscs. The type genus was *Cliona* of Grant. However, the name Clionidae (Gray, 1840) has long been in general use for a family of Pteropod molluscs, with *Clione* Pallas as the type genus. The sponge family may be called Thoosidæ, from *Thoosa* Hancock, the next oldest genus.

T. D. A. COCKERELL

SCIENTIFIC BOOKS

SOME NEW BOOKS ON GENETICS

Genetics in Plant and Animal Improvement. By D. F. JONES. viii + 568 pp., 229 figures. John Wiley & Sons, N. Y. Price $4.00. 1925.

Principles of Genetics, an Elementary Text with Problems. By E. W. SINNOTT and L. C. DUNN. xviii + 431 pp., 140 figures. McGraw-Hill Book Co., N. Y. Price $3.50. 1925.

Animal Genetics, an Introduction to the Science of Animal Breeding. By F. A. E. CREW. xx + 420 pp., 67 figures. Oliver and Boyd, Edinburgh. Price 15/— 1925.

THREE new text-books on genetics have recently been published. There was no dearth of texts before. Apart from the pioneer and standard books by Bateson and Punnett in England, followed by those of Lock, Doncaster and Darbishire and the German texts by Baur, Goldschmidt and Johannsen, there had been published in America alone books by Babcock and Clausen, Castle, Conklin, Coulter, Morgan and Walter, besides several texts dealing primariiy with eugenics. It would seem to be a bold author who would seek to extend the list. Yet at the present time genetics is of such general interest in biology that a variety of treatments of the subject is required to meet all needs, and our knowledge of genetics has been increasing so rapidly that no text remains up-to-date unless it is frequently revised or rewritten. In this state of affairs a fresh and original treatment of the topic is welcome and any new contribution to the only-partly-solved problem of how successfully to teach genetics is thrice welcome.

Jones has produced one of the best text-books on genetics that has yet appeared. He approaches the subject from the viewpoint of one interested in the increase of the world's food supply consisting of plant and animal products. He recognizes that the area available for agriculture is already largely occupied and can not be extended much further. It is therefore incumbent on the farmer to utilize to its fullest capacity the agricultural land now available. This can be done in part by better methods of farming and by improved machinery. It is possible also to discover or produce better varieties of cultivated plants and of domestic animals than those now in use. This last can be done best by an intelligent use of the principles of genetics. Those principles Jones proceeds to develop in an orderly way, beginning with the simplest case of Mendelian heredity and proceeding by gradual steps to more complicated and debatable cases, not however giving the reader occasion to doubt for a moment the complete adequacy of Mendelism to explain all cases. One wishes at times that Jones were less of a "fundamentalist" in his devotion to Mendelism; perhaps a dash of scepticism as to some

of the orthodox doctrines might give relish to the dish. It should be stated, however, that there is little to criticize in Jones's treatment of his subject. He develops it in an orderly and interesting way. His statements are clear, his information full and authentic; his examples are well chosen, apt and adequate, but never superfluous, in many cases taken from his own extensive and fundamental researches. He speaks from the fullness of first-hand knowledge, but never to impress the reader with its extent. He has gathered and imparts in an entertaining way much information about the history of cultivated plants and domestic animals. The information is particularly full about what has been done in the way of crop improvement in the agricultural experiment stations of the United States. This feature makes his treatise preeminently useful as a text-book in the agricultural colleges. His chief original contribution is probably found in the discussions of the subjects of inbreeding and crossbreeding to which his own studies have added much. In this connection may be noted a fondness of the author for a pet theory of his own about hybrid vigor (heterosis), that it is only the summated inheritance from the two parents, not due in the slightest degree to the crossbred state itself. The reader will find it difficult to reconcile this view with the high praise bestowed upon "grading," wherein common stock is crossed with pure bred stock, resulting in the production of offspring superior to either. On the whole, Jones has produced an excellent book. Of course there is the occasional slip to which every author is liable, as where on page 7 he refers to the zebu and water-buffalo as one and the same animal. In Chapter II, "training" is treated as coordinate with inheritance and environment, a third factor in determining the character of the individual. This seems of questionable propriety, particularly as regards plants. On page 64, an example of Mendelian inheritance in guinea-pigs is credited to a German plant-breeder, although it was worked out by an American zoologist.

Sinnott and Dunn have written the latest book on genetics, a good one, too, primarily pedagogical in its aims and origins, and for this reason more likely to meet the needs of the teacher than most books on the subject. Much attention has been given to the preparation of "problems" presented at the end of each chapter, with the aim of giving the student practise in applying the principles discussed in the text. This is perhaps a worth-while way to try to get the student to think, but it is doubtful whether it is in any sense a fair substitute for a laboratory course in which the student handles the live material, gathers his own data and feels his way along toward conclusions. Most biological problems involve in their solution other powers of the mind than those used in arithmetic or elementary algebra. For training in scientific method the student should, if possible, be given *real* problems, rather than hypothetical ones.

The text of Sinnott and Dunn is an extremely clear and well-balanced discussion of "principles of genetics" illustrated by well-chosen examples, many of them taken from materials with which the authors themselves have worked, one of them being a botanist, the other a zoologist. A wide range of subjects is covered and the very latest discoveries in genetics are reported with a due sense of the proportion demanded in an elementary treatise. The chapters on "inheritance in man" and the "problems of eugenics" are naturally based on the least percentage of established fact and the largest percentage of speculation of any part of the book. They present eugenics as the eugenicist would have it, the inevitable Edwardses growing in goodness as the plumule of a seedling grows upward, and the Kallikaks going to the bad as the root of a seedling grows down. It is assumed that heredity (not environment) made the Edwardses and Kallikaks what they are reported to have been, but the text does not make it clear, as it should, that this is largely assumption. Also the professional and moneyed classes are assumed to be "abler" than the industrial and laboring classes, and as the former have fewer children it is assumed that the general level of ability is declining. But again the reader is not informed that this conclusion rests on a string of assumptions.

Crew's book is written exclusively from the viewpoint of an animal breeder and makes no use of botanical material, except in connection with the classical experiments of Mendel on garden peas. He does not limit himself, as do Jones and Sinnott and Dunn, to a presentation of principles with a limited number of illustrative cases. He attempts rather an inclusive summary of the more important work to date on animal genetics with especial reference to farm animals, because of their economic importance, and of Drosophila because of its scientific importance.

His book will be found harder reading, especially for the beginner, than either of the other books mentioned, but will be valuable to more advanced students and particularly in America because it includes much material and many references not found in other texts. He gives particular attention to questions of sex-determination, sex-linked inheritance and sex modification, more than a third of the book being devoted to these and related topics. The discussion of Mendelism and its illustration by cases among farm and laboratory animals, with which the book begins, is not particularly lucid, being overloaded with symbols, diagrams and tables, which weary rather than assist the reader. One gets the impression that the writer has not thoroughly assimilated his material or he

would be able to present it in simpler form. The Drosophila work has been studied carefully and is presented in all its theoretical aspects well. On the whole, the book is a distinct and welcome contribution to the literature of genetics.

W. E. CASTLE

SPECIAL ARTICLES

THE SECRETION GRANULES AND THE VACUOLES IN THE LIVING THYROID GLAND

SEVERAL years ago the writer made an extensive study of the development of the various structures of the thyroid gland of the salamander *Ambystoma opacum*. The method employed in this study was the usual histological technique. The histological slides representing the records of this work were demonstrated at several meetings as well as to a number of individual investigators here and abroad and several short articles outlining the results were published.[1] The manuscript of the final paper, which has gone through the hands of editors for the last two years, is now in press. As the present study on the living thyroid gland corroborates the essential findings of the histological study, brief reference to the results of the latter must be made here.

Through the work on amphibian metamorphosis as conducted during the last fifteen years in American and European laboratories the fact has been well established that the metamorphosis of an aquatic salamander larva into a terrestrous animal is the direct result of the function of the thyroid gland. Therefore the structure of thyroid glands taken from metamorphosing salamander larvae should be expected to be representative of the structure of a functioning thyroid gland. Study of such thyroid glands should yield conclusive information as to which of the various known structures of the thyroid gland are the expression of the specific function of this organ. Upon comparing sections through the glands of metamorphosing animals with sections through the thyroids of earlier stages it was found that the most conspicuous characters of the thyroid at the time of metamorphosis are the presence of large numbers of unstainable vacuoles in the cells (these vacuoles I called Anderson vacuoles after Anderson, who was the first one to describe them),[2] the presence of similar vacuoles in the colloid, the scarcity of stainable colloid in the lumen of the thyroid follicles and the collapse of the follicles into frequently solid and star-shaped masses of epithelium. These characters do not develop gradually, but on the contrary come about in a very sudden manner, taking not more than approximately twenty-four hours for their development. The structural peculiarities enumerated above are among the characters typical for the thyroids of exophthalmic goiter patients. Similar resemblances between the thyroids of metamorphosing salamanders and those of exophthalmic goiter patients were found in nearly every other respect.

Although Anderson in 1894[3] described vacuoles in the cells of the thyroid and saw that the colloid vacuoles, under certain conditions, communicate with the vacuoles in the cells, anatomists and pathologists interpret the colloid vacuoles as artefacts due to shrinkage of the colloid in the fixation fluids. In the thyroid of metamorphosing salamanders the colloid vacuoles are found in a condition indicating clearly that they are an unstainable material excreted by the cells in especially large numbers during stages of highly increased functional activity and identical with the unstainable material contained in the Anderson vacuoles of the cells, with which, in the salamander gland, they are found to be in open communication. Careful fixation of human material showed the same relation to be true for the colloid vacuoles in the human thyroid gland. Through the kindness of Professor Martin Heidenhain I had at my disposal, for comparison with my own material, a human thyroid fixed and stained by Professor Heidenhain himself after the Heidenhain-Mallory method, a technique which I found particularly useful in the study of the thyroid. This thyroid shows exactly the same condition as my own material; in many places colloid vacuoles are found in direct communication with the Anderson vacuoles.

From these observations the conclusion was drawn that the colloid vacuoles are not an artefact, but represent an important secretion of the thyroid gland and are derived from the Anderson vacuoles of the thyroid cells.

The precursor of the stainable colloid was found in an acidophilic substance accumulated in the apical cell ends. The so-called secretion granules were found accumulated in the apical cell end and imbedded in the acidophilic substance. As these granules were never found to lie in the follicular lumen and as no other sign indicating that they are excreted could be noticed, their nature as true secretion granules was

[1] Uhlenhuth, E., Proc. Soc. Experim. Biol. and Med., 1923, XX, 494; *Anat. Rec.*, 1924, XXVII, 222; *J. Gen. Physiol.*, 1924, VI, 597; *Zeitsch. wiss. Zool.*, 1925, CXXV, 483.

[2] Anderson, O. A., *Arch. Anat. und Physiol.*, Anat. Abt., 1894, 177.

[3] *Ibid.*

doubted and, in accordance with other observations, it was assumed that these granules play some other rôle in the elaboration of the colloid.

The study of the living thyroid gland was undertaken with the hope to obtain further information about the nature of the Anderson vacuoles, of the colloid vacuoles and of the granules of the thyroid cells. The salamander *Ambystoma maculatum* was used in this work. Up to the present time only the thyroids of adult animals and of larvae before metamorphosis have been examined. Before examination the thyroids were stained with neutral red. In adult animals the best results were obtained by injecting the dye intraperitoneally. The larvae were stained in the manner described by Fischel[4] and by McClure.[5] After the tissues had become sufficiently imbibed with the dye, the thyroids were removed and examined on the slide under the microscope immediately after extirpation.

Vacuoles in the cells were found in both the adult and larval glands. If the thyroids of adult animals are removed cautiously, no vacuoles are usually present. If, however, rough handling, during removal or otherwise, precedes examination, formation of vacuoles takes place. In this respect the thyroid behaves very differently from other epithelial organs. In the epithelial cells of the skin of the same animals or of the larvae no vacuoles can be made to appear by mechanical stimulation. In the thyroid the vacuoles are located between the nuclei of the cells. If cell borders are not visible, it is impossible to say whether the vacuoles are extracellular or intracellular. In many thyroids the cell borders were visible and of extreme clearness; in these instances the vacuoles were intracellular. They are especially distinct, if the follicles are viewed from the surface, but may be seen also in optical sections of the cells. The vacuoles are located in largest numbers at the basal pole of the cells and are often found even between the nucleus and the peripheral wall of the cell, but smaller numbers of vacuoles are found also at the apical cell end. Immediately after removal of the gland they are of small size (approximately of the size of a nucleolus), but may increase in size later on and attain half or even fully the size of a nucleus. The formation of new vacuoles and the increase in the size of the old ones ceases after the organ has been exposed on the slide for thirty minutes to an hour.

In the thyroids of young larvae no vacuoles comparable to those seen in adult glands could be found, even if the glands were handled and pressed severely. Instead small vacuoles of yellowish green color are present, in moderate numbers, in the cell plasma. In contradistinction to the other kind of vacuoles they stain red with Sudan III and Scarlet Red and are fat vacuoles derived probably from the yolk. The first vacuoles similar in appearance to those of adult glands were observed in thyroids taken from larvae of 11.5 mm body length and forty-one days of age. One or several vacuoles may be found in such glands, which are located at the periphery of the follicle just between two neighboring cells and apparently extracellular. No other vacuoles are present at that stage. This condition persists nearly up to metamorphosis. In animals just about ready to shed their skin for the first time conditions are decidedly different from either the adult or the larval gland. In addition to the vacuoles characteristic for the adult gland, and independent of mechanical stimulation, small vacuoles are present in these glands, which are about twice as large as a nucleolus and are surrounded by very tiny dust-like granules. The granules are closely attached to the walls of the vacuoles and, in the Neutral Red specimen, stain a dark reddish brown. In high cuboid or cylindrical cells they are spread throughout the apical half of the cell; in low cuboid cells they are frequently arranged in one or two rows parallel with, and located just below, the apical cell wall and apical to the secretion granules of the cell. Especially these latter vacuoles resemble in a very striking manner the Anderson vacuoles as observed in sections through the thyroid gland.

The colloid vacuoles were studied so far only in the thyroids of larval animals. In early stages they are absent. The first colloid vacuoles were found in an animal of 11.9 mm body length and forty-seven days of age. Only in larvae which are immediately before the first skin shedding do the colloid vacuoles become of real significance; at that stage the number of these vacuoles is considerable. It was of especial importance to ascertain whether, as deduced from the histological sections, the colloid vacuoles are excreted from the cells. So far four vacuoles were observed during the process of excretion from the cell. In one instance a vacuole was pushed forth from the cell into the follicular lumen, while the cell was under observation. It attained rapidly about half the size of a nucleus and then stopped increasing. No break of the cell wall could be noticed in this instance. In another thyroid a small colloid vacuole was attached to the cell by a clear hollow stalk penetrating the cell wall and extending into the cell plasma. This vacuole increased slowly in size till it attained about the size of a nucleus. It resembled greatly the communicating colloid vacuoles observed in the sections.

[4] Fischel, A., *Anat. Hefte*, 1901, XVI, 415.

[5] McClure, C. F. W., *Am. Anat. Memoirs* (of the Wistar Inst.), No. 8, 1918.

The secretion granules observed in thyroid sections correspond in every respect to the granules staining with Neutral Red. The first neutral red granules were found in thyroids in which the differentiation of the solid cell column into primary follicles had just started. During the larval period the granules are spread throughout the cell, but are especially dense at the apical pole. In several larvae which were close to metamorphosis the granules showed a tendency to become massed at the apical pole; no granules at all were present at the basal cell end. Although colloid is excreted from the cells into the lumen of the follicles throughout the larval period, an excretion of the granules into the follicular lumen has never been noticed; no granules whatsoever could be detected in the colloid. Moreover, a careful comparison made, in the vitally stained larvae, between the granules of the thyroid cells and the true secretion granules (the mucine granules) of the Leydig cells of the skin showed that there is no resemblance between the reactions of these two kinds of granules towards the Neutral Red.

Although the study of the living thyroid gland, as compared to the histological study, so far has not disclosed any new facts, it has at least been instrumental in demonstrating that the Anderson vacuoles and the colloid vacuoles are not artefacts, but are structures characteristic of the living thyroid gland. Furthermore, it seems to be certain that the so-called secretion granules of the thyroid cells are not actually excreted from the cells.

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A POTATO NECROSIS RESULTING FROM CROSS-INOCULATION BETWEEN APPARENTLY HEALTHY POTATO PLANTS

WHILE conducting investigations on the manifestation of virus disease symptoms on different potato varieties and seedlings[1] in the Washington greenhouses during the winter of 1923–24, the writer found a necrosis on certain seedlings. The symptoms of these necrotic or streaked seedlings resembled those of so-called "streak" in potato. This malady is distinguished in the early stages by necrotic spots on the leaf parenchyma; later, necrosis appears along the veins, producing a streaked appearance. Likewise, linear necrotic lesions appear on the petioles and stems, usually resulting in the death of the shoot in a short time; shoots from four to ten centimeters above ground may die in a few days. Frequently only one side of the shoot or even of a compound leaf manifests these symptoms. Necrotic areas may develop on very young actively growing shoots and leaves, as well as on apparently full-grown plants. These facts suggest that the inciting agent is transmitted through the conducting elements.

Necrosis developed on certain seedlings as a result of tuber grafts on mild mosaic and spindle tuber Green Mountains. Other seedlings from different parentage and other varieties treated similarly at this time manifested only mild mosaic and spindle tuber symptoms. All the healthy controls from seed pieces from the same tubers as the grafted seed pieces remained healthy. Also the mosaic and spindle tuber Green Mountain plants in these grafts disclosed only mosaic and spindle tuber.

Similar necrosis again developed on the same seedlings and on an additional seedling when these investigations were continued in the fall of 1924 under the same conditions as before. At this time studies also were initiated on the reaction of some apparently healthy foreign potato varieties, *viz.*, Duke of York, Bravo, Paul Kruger, Koksiaan[2] and Arran Comrade,[3] to the mosaic, leaf roll and spindle tuber diseases in Green Mountains. On these foreign varieties necrosis, as on the seedlings, developed when grafted on mosaic, spindle tuber and leaf roll Green Mountains. Some of the shoots became necrotic when but a few centimeters above ground, without manifesting the symptoms of the particular disease represented in the Green Mountains. Other shoots plainly disclosed either mosaic, leaf roll or spindle tuber. The controls, plants from the seed pieces from the same tuber as the grafted seed pieces, remained healthy. Likewise, no necrosis appeared on the mild mosaic, spindle tuber or leaf roll Green Mountains. In a similar series of mild mosaic Green Mountain tuber grafts on healthy Green Mountains, Rural New Yorkers, Irish Cobblers, Spaulding Rose, Early Rose and Bliss Triumphs, no necrotic symptoms developed.

From these peculiar manifestations and in view of Professor James Johnson's[4] recent discovery of faint mottling or irregular necrotic areas produced on tobacco by cross-inoculations with juice from apparently healthy potatoes, it was surmised that this necrosis might be due to the reaction between certain

[1] Potato seedlings were furnished through the courtesy of Dr. C. F. Clark, Bureau of Plant Industry, U. S. Department of Agriculture.

[2] Obtained through the courtesy of Dr. H. M. Quanjer, Wageningen, Holland.

[3] Obtained through the courtesy of Dr. George H. Pethybridge, Harpenden, England.

[4] Johnson, James, "A virus from potato transmissible to tobacco," *Phytopathology*, V. 15, No. 1, p. 46–47. 1925.